The Evaluation of On-line Performance Test Methods for Aqueous Cleaner for Metal Surface Finishing Processes

By
Thomas M. Tam, Ralph Wyngarden and Anthony F. Naylor
Orgn. 48-90, Bldg. 573
1111, Lockheed Way,
Sunnyvale, CA
94089-3504

Due to environmental regulations, the use of Ozone Depleting Chemicals (ODC's) is being phased out. To meet this new regulation, Lockheed Missiles & Space Company is currently using an aqueous cleaner to replace 1,1,1 trichloroethane, an ODC, to prepare aluminum surface prior to adhesive bonding, conversion coating, or anodizing.

Currently a vendor recommended titration method is being used to monitor and control the aqueous cleaner. This titration method only measures the alkalinity of the bath. To better control the process, a method of measuring the performance of the bath is desired. This test should be able to indicate the performance of the bath on a numeric scale, and be quick, simple and inexpensive.

This presentation consists of two parts. The first part evaluates three different methods of measuring contaminant adhering to the test panels. The methods are:

- Weight Gain
- Optically Stimulated Electron Emission (OSEE)
- Nonvolatile Residue (NVR)

The second part of the study of the presentation evaluates the use of these methods to control the aqueous cleaner.

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R. Wyngarden
&
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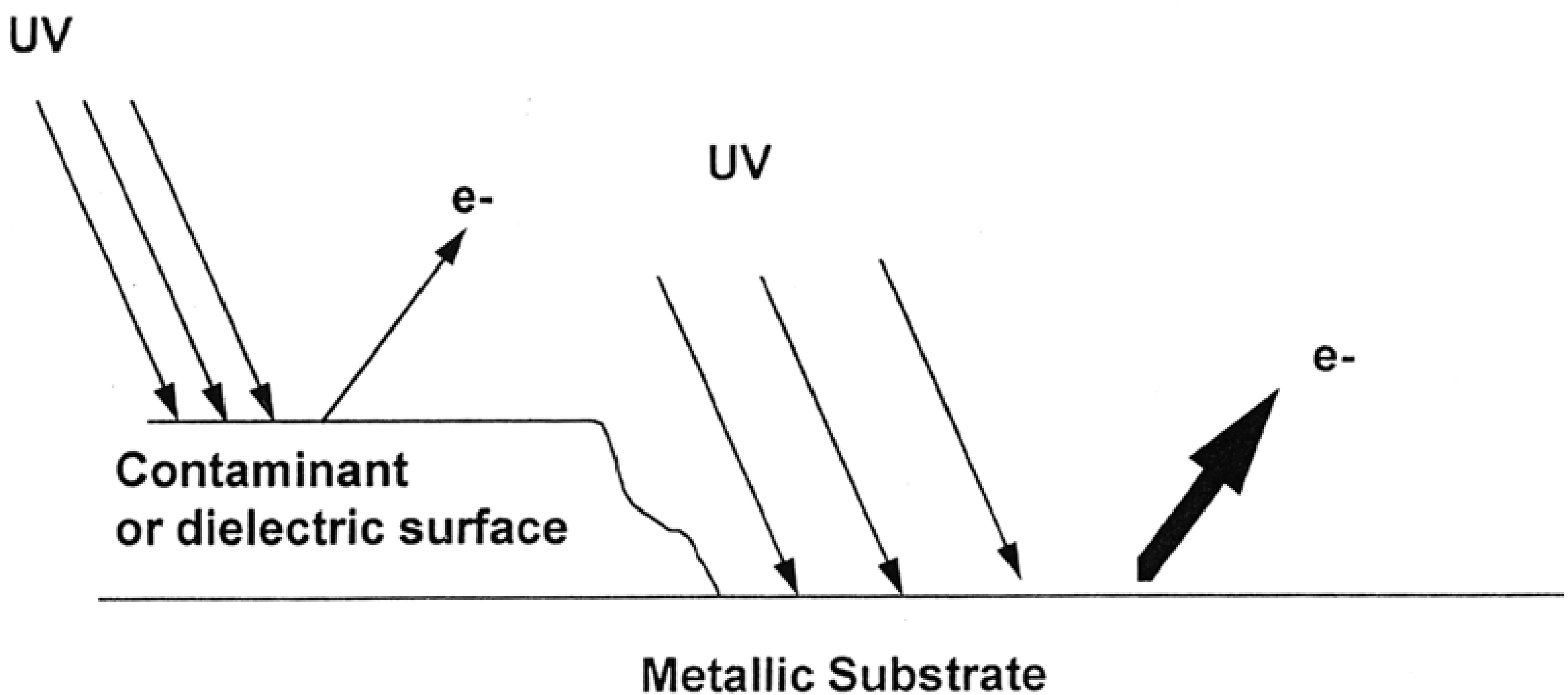
Two Part Study

- **Dynamic range of the 3 methods**
- **Application of the test methods on an Aqueous cleaner**

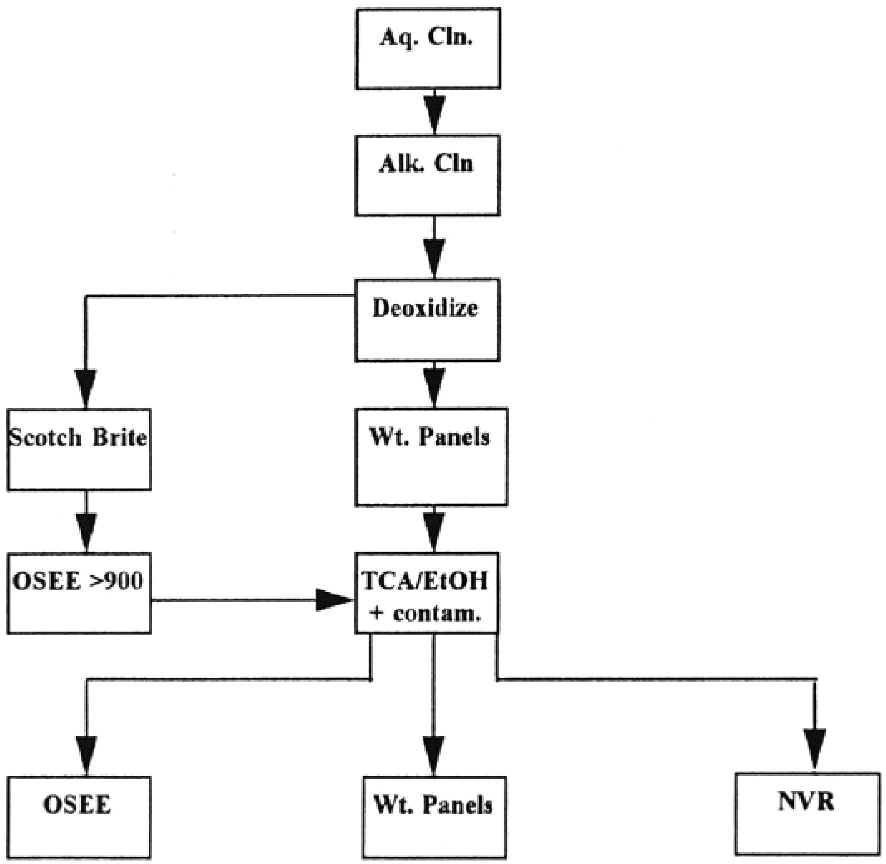
Test Methods

- Objective: Evaluate performance test methods
  - Weight Change
  - Non-Volatile Residue (NVR)
  - Optically Stimulated Electron Emission (OSEE)

How OSEE Works



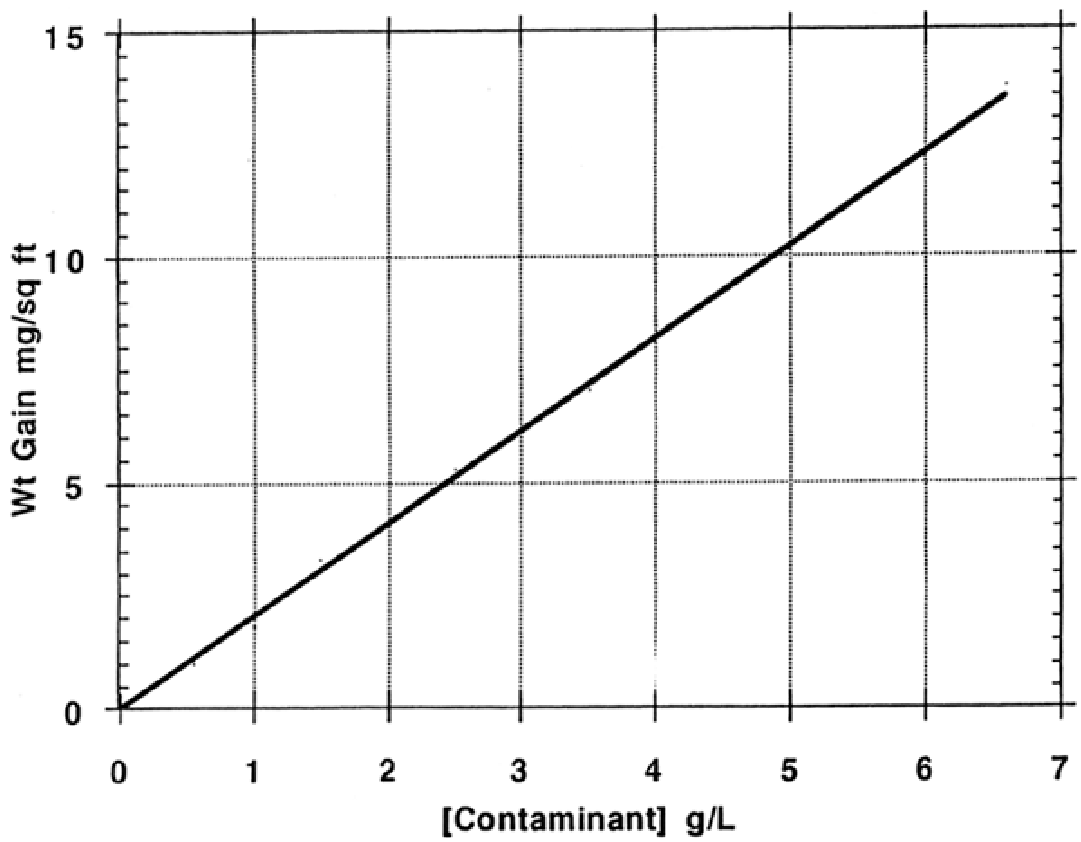
Preparation of Panels for Wt. Gain, OSEE, & NVR Analysis



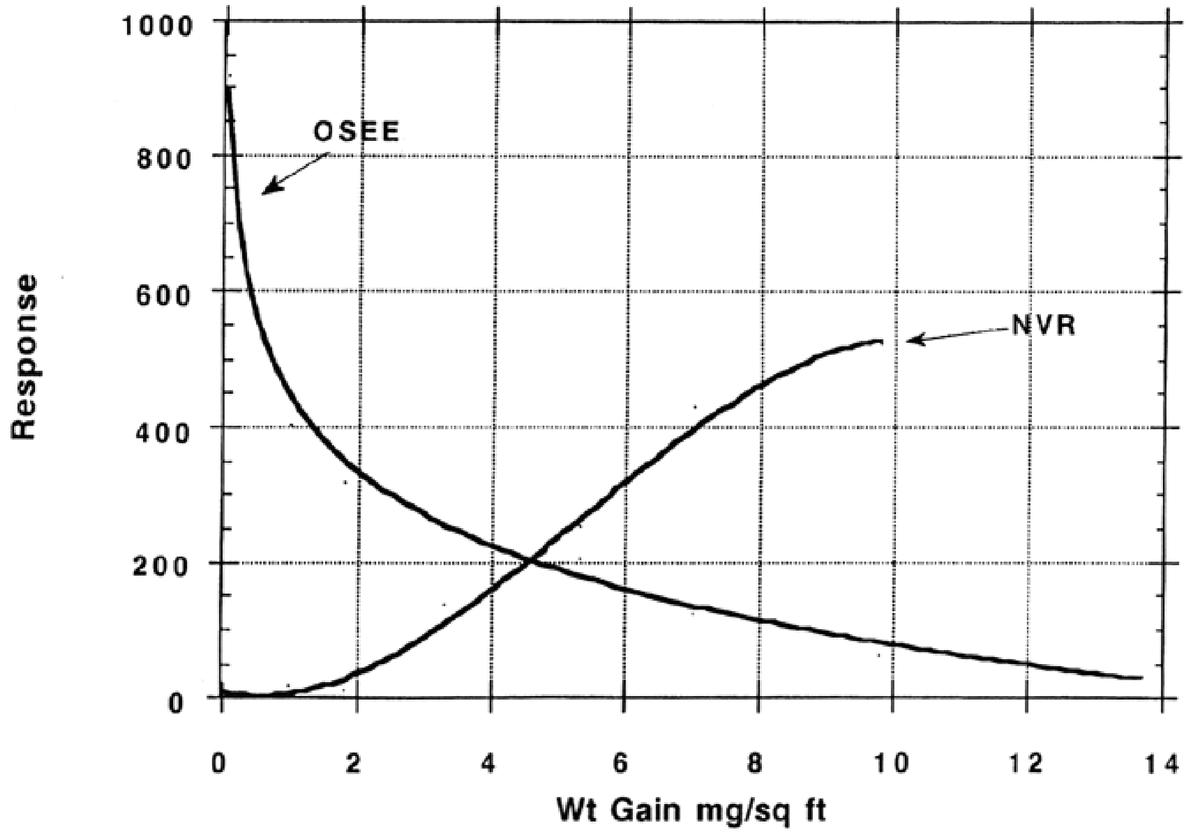
Composition of the Contaminant Mixture

Contaminant	Make Up (% wt/wt)
Rust Lick	40
Acculube	40
Tap Magic	10
Aluma Cut	10

Weight Gain vs. Weight of Dissolved Contaminant



OSEE Signal vs. Weight Gain

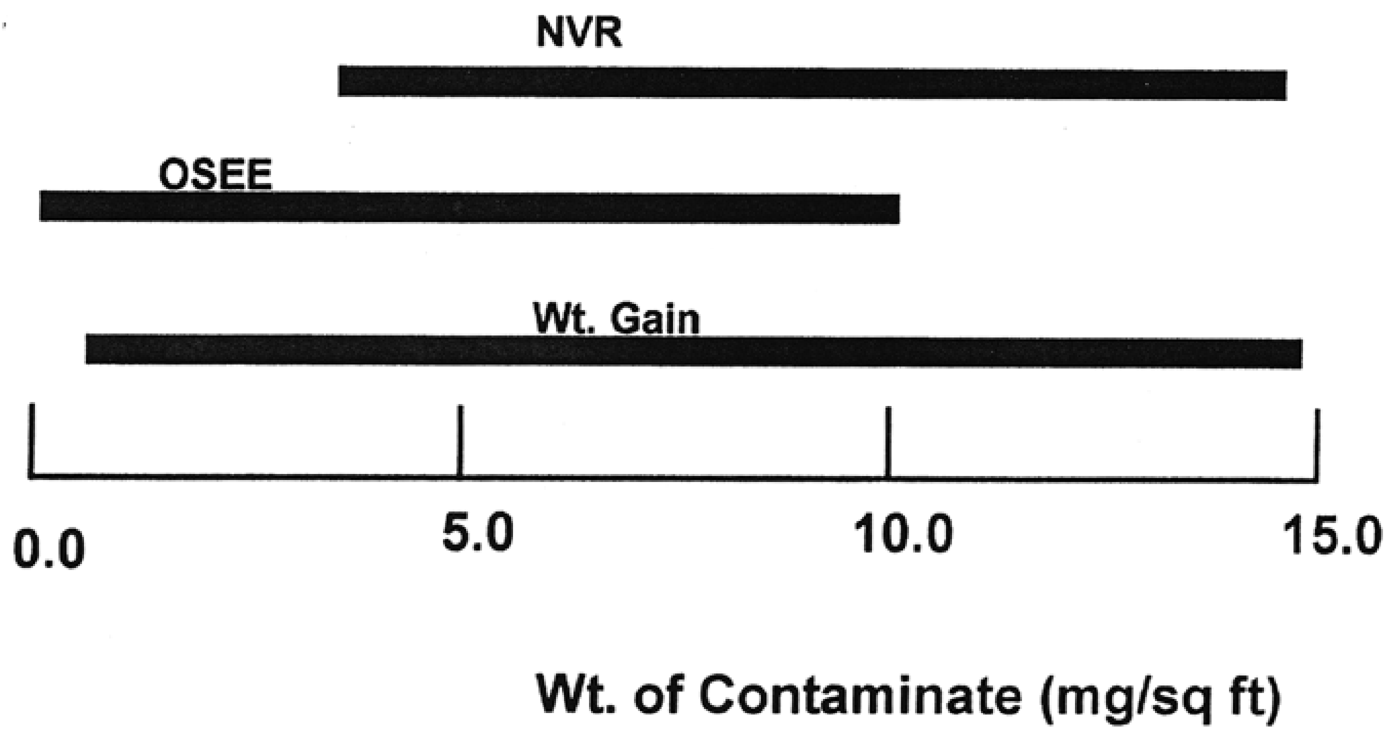


NVR Concerns

Wt. Gain	NVR	Wt. After NVR
1 (0.2)	0.18 (0.24)	0.1 (+0.2)
1.8 (0.5)	0.12 (0.16)	0.5 (0.4)
3.3 (0.3)	1.38 (0.33)	0.37 (0.07)
5.3 (0.8)	2.06 (0.63)	1.0 (0.3)
7 (1)	4.3 (1.2)	0.2 (0.2)
9.8 (0.8)	5.22 (0.8)	1.1 (0.4)

All Units are in mg/sq ft

Conclusion
Dynamic Ranges of the 3 Test Methods



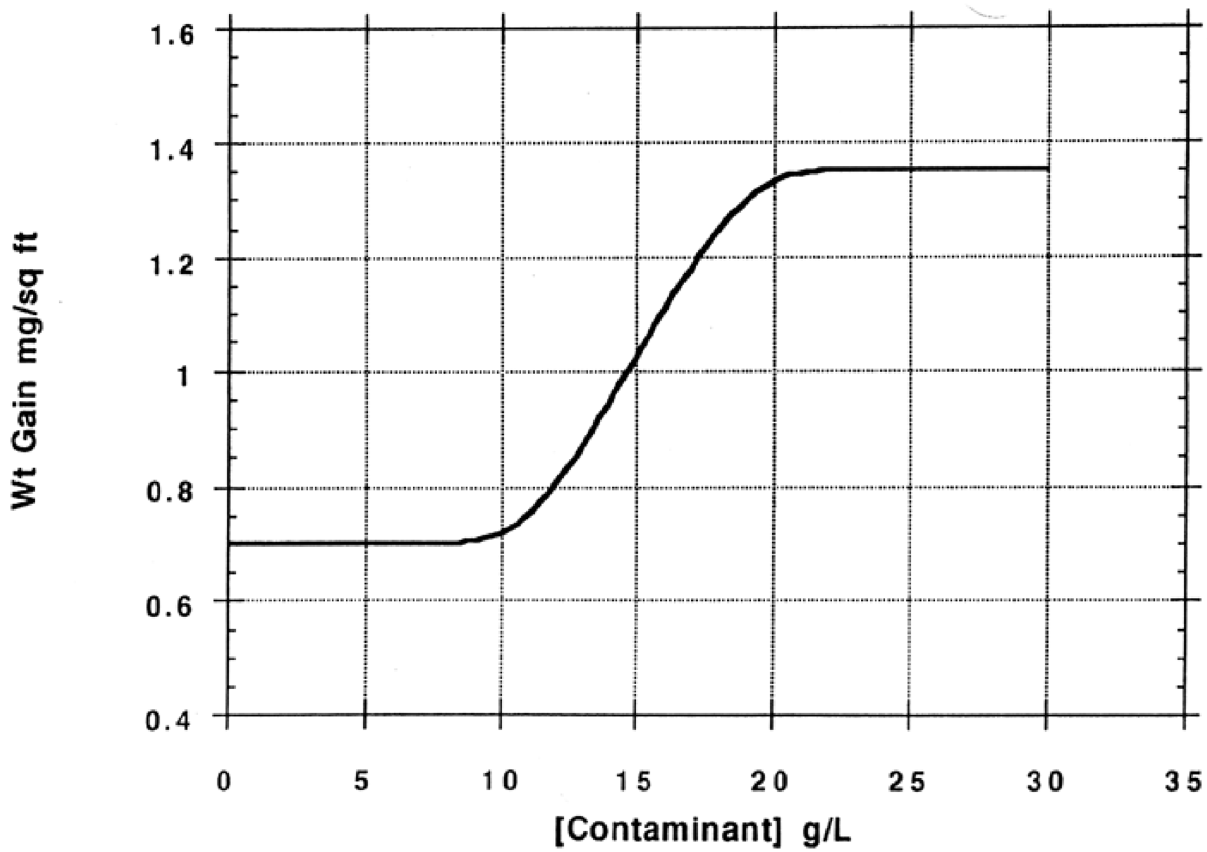
Application of 3 Test Methods on an Aq. Cleaner

‘Clean’ vs. ‘Dirty’ Panel

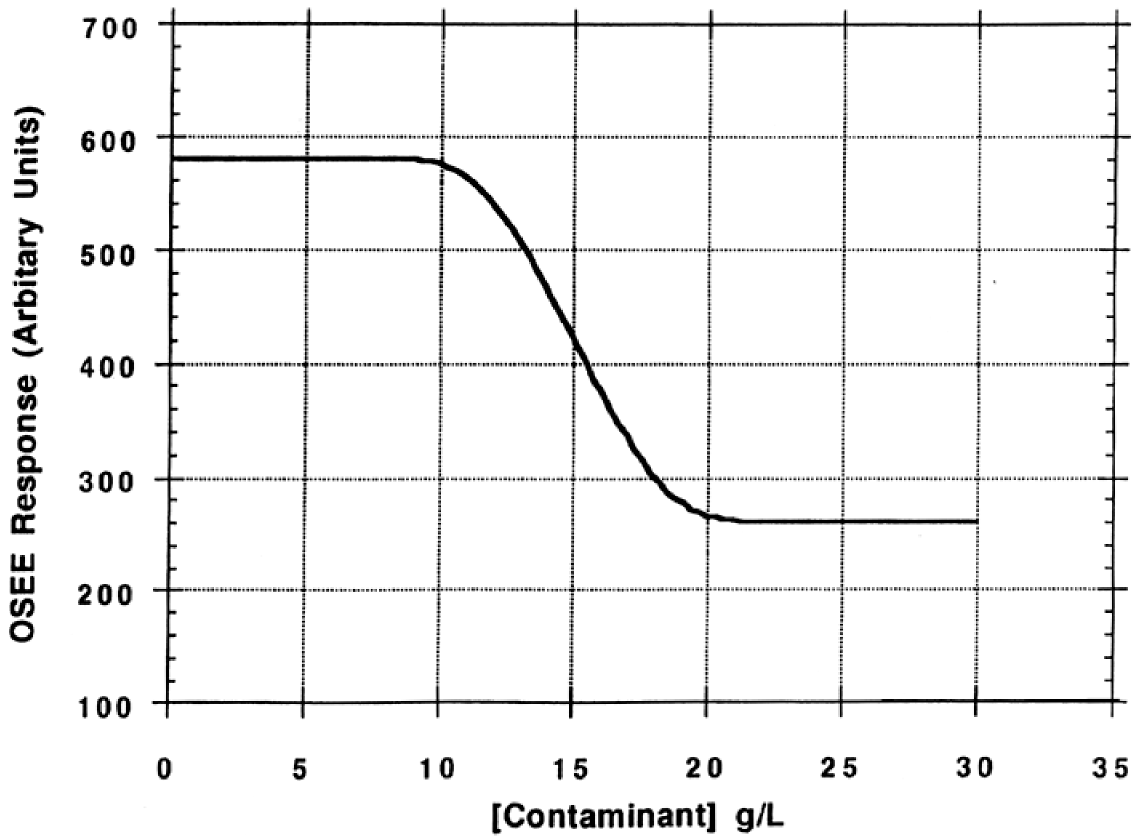
Wt. of Conta. Deposit
‘Clean’ = 0 mg/sq ft
‘Dirty’ = 14.2 mg/sq ft

[Contaminant]	Wt. Gain (mg/sq ft)		OSEE	
g/l	Clean	Dirty	Clean	Dirty
0	0.6	0.8	675	475
5	1.1	0.8	636	496
10	0.6	0.5	661	558
20	1.4	1.3	282	233
30	1.1	1.3	397	145

Panel Weight Change vs. Contaminant Loading in Cleaner



OSEE Response vs. Contaminant Loading in Cleaner



Effect of Agitation
Process vs. Rinse H2O

	'Clean' Panel		'Dirty' Panel	
Flow rate (a)	**Wt1 (std. dev.)**	**OSEE (std. dev.)**	**Wt2 (std. dev.)b**	**OSEE (std. dev.)**
		Agitated Rinse		
0	1.4 (0.3)	837 (96)	1.2 (0.2)	806 (119)
1	0.6 (0.2)	593 (71)	0.60 (0.2)	552 (74)
3.8	1.0 (0.4)	665 (210)	0.8 (0.3)	804 (121)
Average	**1**	**700**	**0.9**	**720**
		Stagnate Rinse		
0	3 (1)	231 (44)	4.4 (0.9)	233 (67)
1	1.3 (0.2)	397 (118)	1.1 (0.3)	145 (53)
3.8	2.0 (0.3)	205 (46)	2.3 (0.4)	212 (61)
Average	**2**	**278**	**2.6**	**197**

a) **Flow rate of cleaner L/min sq ft**
b) **Weight of contaminant (mg/sq ft) left on panels after being processed by cleaner**

Conclusion

- Clean to equilibrium
- Agitation of Process Solution is not important
- Agitation of Rinse is critical
- Wt. Gain: suitable, > 2 mg/sq. ft
- OSEE: most sensitive, 1 – 10 mg/ft2
- NVR: least desirable